

WHAT IS CLAIMED IS:

1. A battery comprising:

at least one metallic lithium or lithium alloy anode;

at least one cathode,

and a polyimide-based electrolyte separator disposed between said at least one metallic lithium or lithium alloy anode and said at least one cathode; said polyimide-based electrolyte separator comprising a soluble polyimide, a lithium salt, and from about 10% by weight to about 60% by weight of solvent.

2. A battery as defined in claim 1 wherein said polyimide-based electrolyte separator comprises from about 15% by weight to about 50% by weight of solvent.
3. A battery as defined in claim 1 wherein said polyimide-based electrolyte separator comprises from about 20% by weight to about 40% by weight of solvent.
4. A battery as defined in claim 1 wherein said solvent is selected from the group consisting of N,N-methylpyrrolidinone (NMP), gamma-butyrolactone, and sulfamides of formula; $R_1R_2N-SO_2-NR_3R_4$, in which R_1 , R_2 , R_3 and R_4 are alkyls having between 1 and 6 carbon atoms and/or oxyalkyls having between 1 and 6 carbon atoms or combinations thereof.

5. A battery as defined in claim 1 wherein said at least one cathode comprises a current collector, an active material; an electronic conductive filler; and an ionically conductive electrolyte polyimide binder; wherein said electrolyte polyimide binder comprises a lithium salt and a pre-imidized soluble polyimide, and wherein the lithium salt and the pre-imidized soluble, polyimide are soluble in a polar solvent.
6. A battery as defined in claim 1 wherein said at least one cathode comprises a current collector, an active material; an electronic conductive filler; an ionically conductive electrolyte polyether and a lithium salt.
7. A battery as defined in claim 6 wherein said active material is selected from the group consisting of: LiCoO_2 ; LiMnO_2 ; LiMn_2O_4 ; LiNiO_2 ; LiV_3O_8 ; V_2O_5 ; $\text{Li}_4\text{Ti}_5\text{O}_{12}$ and LiFePO_4 .
8. A battery as defined in claim 5 wherein said active material is selected from the group consisting of: LiCoO_2 ; LiMnO_2 ; LiMn_2O_4 ; LiNiO_2 ; LiV_3O_8 ; V_2O_5 ; $\text{Li}_4\text{Ti}_5\text{O}_{12}$ and LiFePO_4 .
9. A battery as defined in claim 1 wherein said lithium salt is selected from the group consisting of lithium tetrafluorosulfonimide, lithium salts derived from bis perhalogenoacyl and bis sulfonylimide, LiCl , LiBr , LiI , $\text{Li}(\text{ClO}_4)$, $\text{Li}(\text{BF}_4)$, $\text{Li}(\text{PF}_6)$, $\text{Li}(\text{AsF}_6)$, $\text{Li}(\text{CH}_3\text{CO}_2)$, $\text{Li}(\text{CF}_3\text{SO}_3)$, $\text{Li}(\text{CF}_3\text{SO}_2)_2\text{N}$, $\text{Li}(\text{CF}_3\text{SO}_2)_3$, $\text{Li}(\text{CF}_3\text{CO}_2)$, $\text{Li}(\text{B}(\text{C}_6\text{H}_5)_4)$, $\text{Li}(\text{SCN})$, and $\text{Li}(\text{NO}_3)$.

10. A battery as defined in claim 1, wherein said battery holds an electric charge.
11. An electrolyte comprising a soluble polyimide, a lithium salt, and from about 10% by weight to about 60% by weight of solvent.
12. An electrolyte as defined in claim 11 comprising from about 15% by weight to about 50% by weight of solvent.
13. An electrolyte as defined in claim 11 comprising from about 20% by weight to about 40% by weight of solvent.
14. An electrolyte as defined in claim 11 wherein said solvent is selected from the group consisting of N,N-methylpyrrolidinone (NMP), gamma-butyrolactone, and sulfamides of formula: $R_1R_2N-SO_2-NR_3R_4$, in which R_1 , R_2 , R_3 and R_4 are alkyls having between 1 and 6 carbon atoms and/or oxyalkyls having between 1 and 6 carbon atoms or combinations thereof.
15. A process for preparing a battery, the process comprising the steps of:
 - a) preparing a metallic lithium or lithium alloy sheet;
 - b) preparing a cathode slurry comprising a active material; an electronic conductive filler; a lithium salt and an ionically conductive electrolyte binder;
 - c) preparing an electrolyte solution comprising a soluble polyimide, a lithium salt, and from about 10% by weight to about 60% by weight of solvent;

- d) applying said cathode slurry onto a current collector to form a cathode film;
 - e) applying said electrolyte solution onto said cathode film to form an electrolyte separator;
 - f) applying said metallic lithium or lithium alloy sheet onto said electrolyte separator to form an electrochemical cell.
16. A process as defined in claim 15 further comprising the step of cross-linking of the polyimide electrolyte by exposing said polyimide electrolyte to thermal energy, UV radiation or electron beam.
17. A process as defined in claim 15 further comprising the steps of
- a. applying said cathode slurry onto a second side of said current collector to form a second cathode film;
 - b. applying said electrolyte solution onto said second cathode film to form a second electrolyte separator; thereby forming a bi-face electrochemical cell;
 - c. stacking a plurality of bi-face electrochemical cell to form a battery.
18. A process for preparing a battery, the process comprising the steps of:
- a. preparing a metallic lithium or lithium alloy sheet;
 - b. preparing a cathode slurry comprising an active material; an electronic conductive filler; a lithium salt and an ionically conductive electrolyte binder;

- c. preparing an electrolyte solution comprising a soluble polyimide, a lithium salt, and from about 70% by weight to about 95% by weight of solvent;
- d. applying said cathode slurry onto a current collector to form a cathode film;
- e. applying said electrolyte solution onto said cathode film;
- f. drying said electrolyte solution to evaporate from 10% by weight to 80% by weight of said solvent to form an electrolyte separator comprising from about 10% by weight to about 60% by weight of solvent;
- g. assembling said metallic lithium or lithium alloy sheet onto said electrolyte separator to form a battery.

19. A process as defined in claim 18 further comprising the step of cross-linking of the polyimide electrolyte by exposing said polyimide electrolyte to thermal energy, UV radiation or electron beam.

20. A process as defined in claim 19 further comprising the steps of
- a. applying said cathode slurry onto a second side of said current collector to form a second cathode film;
 - b. applying said electrolyte solution onto said second cathode film to form a second electrolyte separator and drying said electrolyte solution to evaporate from 10% by weight to 80% by weight of said solvent to form an electrolyte separator comprising from about 10% by weight to about 60% by weight of solvent; thereby forming a bi-face electrochemical cell;
 - c. stacking a plurality of bi-face electrochemical cell to form a battery.

21. A battery comprising:

at least one anode;

at least one cathode,

and a polyimide-based electrolyte separator disposed between said at least one anode and said at least one cathode; the polyimide-based electrolyte separator comprising a cross linked polyimide matrix, a lithium salt, and from about 10% by weight to about 60% by weight of solvent.

22. A battery as defined in claim 21 wherein said polyimide-based electrolyte separator comprises from about 15% by weight to about 50% by weight of solvent.

23. A battery as defined in claim 21 wherein said polyimide-based electrolyte separator comprises from about 20% by weight to about 40% by weight of solvent.

24. A battery as defined in claim 21 wherein said solvent is selected from the group consisting of N,N-methylpyrrolidinone (NMP), gamma-butyrolactone, and sulfamides of formula; $R_1R_2N-SO_2-NR_3R_4$, in which R_1 , R_2 , R_3 and R_4 are alkyls having between 1 and 6 carbon atoms and/or oxyalkyls having between 1 and 6 carbon atoms or combinations thereof.